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Total daily fluoride intake and the relative contributions of foods, drinks and toothpaste among 3- to 4-year-old children in the Gaza Strip - Palestine.

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Summary

Background: Children in Gaza Strip suffer from a high prevalence of dental fluorosis.

Aims: To estimate and compare total daily fluoride (F) intake (TDFI) and investigate the relative contributions of different sources of F to TDFI, in 3-4 year-old children in Gaza Strip, exposed to low (<0.7 mg/l), moderate (0.7 - 1.2 mg/l) or high (>1.2 mg/l) F concentrations in tap water.

Design: A 3-day food diary, and samples of tap water, drinks, foods, toothpastes and toothbrushing expectorate were collected from 216 children receiving low ($n=81$), moderate ($n=72$) or high ($n=63$) F concentrations in tap water. F concentration of samples was analysed using an F-Ion Selective Electrode. TDFI from all sources was estimated. Data was analysed by ANOVA and Tukey's test.

Results: The mean (\pm SD) F concentration in low, moderate and high F tap waters was $0.21(\pm 0.15)$, $0.91(\pm 0.13)$ and $1.71(\pm 0.35)$ mg/l respectively. Mean (\pm SD) TDFI was $0.02(\pm 0.01)$, $0.04(\pm 0.01)$ and $0.05(\pm 0.03)$ mg/kg BW/d respectively ($P<0.0001$). Foods made the largest contribution (63.9%) to TDFI.

Conclusion: TDFI increased as F concentration in tap water increased. Foods were the primary source of F. Programmes for monitoring fluoride exposure should consider the fluoride concentration of water used for food preparation and local dietary behaviours

Introduction

An appropriate fluoride (F) intake minimizes the risk of caries and dental fluorosis in parallel. A total F intake of 0.05- 0.07 mg/kg bw/day in children younger than 12 years of age is regarded as optimum for dental health benefits¹. The upper tolerable intake of fluoride for children up to 8 years of age is 0.1 mg/kg bw/day during infancy, to minimise the risk of dental fluorosis².

Drinking water has been shown to be the predominant source of F intake in some societies¹⁻⁴.

However, recent studies have indicated that tap water F concentration is not necessarily the primary indicator for total F intake in all populations⁵ as both food ingredients and food prepared with fluoride containing water can be major fluoride sources⁶. A positive association has been reported between a high F concentration in drinking tap water supplied from ground water wells and the prevalence and severity of dental fluorosis in children in Gaza Strip^{7,8}, where the prevalence of fluorosis in children is as high as 78%⁷.

Observation of dietary practices of children in the Gaza strip show a high proportion are exclusively breast fed for the first 6 months of life (~83%); approximately 40% consume milk reconstituted with tap water by age 16 months of age and most consume tea by the age of one (98%)⁷ with tea being commonly added to nursing bottles⁸. There is a need for information on the principal sources of F intake by children residing in areas of high fluorosis prevalence, such as the Gaza Strip. Such information enables monitoring of F intake and informs the development of appropriate preventive strategies for dental fluorosis. In view of the current lack of accurate information on the impact of home tap water F concentration on F intake, the aims of this paper were to compare the total daily F intake (TDFI) of 3-4 year-old children in Gaza Strip who were exposed to <0.7, 0.7-1.2 or >1.2 mg/l F respectively in their home tap water, and to investigate the relative contributions of different F sources to TDFI.

Materials and Methods

This study was a cross sectional observational study. The research was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Helsinki Committee in the State of Palestine. Written informed consent was obtained from all parents of participants. Approvals were secured from the Palestinian Ministry of Health, United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) as well as the local municipalities.

Preliminary investigations identified the following study areas for recruitment of 3-4 year-old children living in the Gaza Strip, Palestine: Beit Lahia and Alnaser with tap water F concentration <0.3 mg/l F, Albureej with tap water F concentration ranging from 0.7 to 1.2 mg/l F, and Alshaaf with tap water F concentration of >2 mg/l F.

All health records of children born in 2002 in the selected areas were collected from governmental and UNRWA health care centres. A power calculation for sample size determined that with 36 children in each group, the study would have 90% power to detect a difference in mean F intake of 0.1 mg F/day assuming a significance level of 5%. It was anticipated that approximately half the recruited children might complete the study, therefore, 72 children from each of three tap water areas were recruited after a list of 100 randomly selected healthy children in each area was obtained, resulting in a total sample size of 216 children.

The parents of the first 72 children in each area list were contacted by telephone to explain the study and ask for expressions of interest for their child to participate in the study. If they expressed an interest the researcher visited them to provide an explanatory letter, and a parent information sheet and to answer any questions prior to obtaining written consent and collecting demographic information about the child. If any parents declined to participate or their child did not meet the study inclusion criteria the next child on the area list of 100 children was contacted. Inclusion

criteria were healthy children born in 2002 (initially 4 years-old) who had been resident in the selected area since birth, had never received dietary F supplements or professionally applied F and did not exhibit persistent bed-wetting. Exclusion criteria included chronic metabolic and renal disease.

Dietary data collection

Dietary information was collected using a purpose-designed estimated food diary, as described by Zohoori et al ⁵. Parents were asked to record all food and drink consumed by their child over 3 consecutive days (two weekdays and one weekend day). Instructions for completion of the diary stressed the importance of recording all foods and drinks consumed over the 3-day period. Information requested included: a description of the food or drink, the amount consumed described using household measures and recipes of home-prepared foods/drinks. On completion of the diary parents were interviewed to clarify and enlarge on information reported and to estimate portion size using models and pictures of commonly used dietary receptacles (glasses, spoons and dishes) of known volumes. To estimate portion sizes of some foods (e.g. bread, meats fruits and vegetables) which could not be measured using household measures, pictures of different weighed amounts of these foods were used. For any ready-made drinks and foods that the children consumed during the recording period, parents were asked to retain the packaging to enable the portion size of the consumed item to be recorded.

Parents of children in the study were asked to collect a tap water sample during each day of dietary recording. The 3 water samples were then mixed together and a 5 ml sample retained for F analysis. Samples of foods and drinks (including waters from other sources) which the child consumed over the 3 days were collected in order to analyse the F content and estimate the child's F intake.

The height of each child was measured using a stadiometer (SOEHNLE) vertically without shoes to the nearest 0.5 cm. Weight was measured using a weighing scale (SOEHNLE) without shoes and jacket to the nearest 0.5 kg. Anthropometric data were also entered into the Fluoride Database ^{5, 12}.

Dietary data analysis

Information on the amounts of foods consumed by the participants was recorded in a purpose-designed Microsoft Access Database 'Fluoride Database'. This database included computerised version of the composition of food tables into which the information on the F content of foods (mg/100g) and drinks was entered. The amounts of foods and drinks consumed by the participants were also entered into the Fluoride Database from which the daily F intake and energy intake (EI (MJ/day) of the participants were determined.

The validity of dietary information was determined by comparing the reported EI to the estimated Basal Metabolic Rate (BMR) determined using Schofield equations⁸ to give a 'Physical Activity Level (PAL)' – the ratio between the BMR and total EI. PAL was compared with other reported standards for EI of 4 year old children⁹⁻¹². The cut-off point for PAL, below which EIs are indicative of under-reporting of food intake for 4 year-old children, is 1.1¹⁰.

Collection of data on tooth brushing

Information about the child's toothbrushing behaviour was obtained from the parents. For children who brushed their teeth, the child was asked to brush his/her teeth as usual and dispense the usual amount of toothpaste on the brush head. The toothpaste brand name, F concentration and F salt (Sodium fluoride or Sodium monofluorophosphate) was recorded from the information on the toothpaste container (tube). Using the method described by Maguire et al¹³, the amount of F ingested through toothbrushing was estimated. Toothpaste samples were also collected for F analysis.

Sample transport and analysis

All collected biological and non-biological samples were kept in F- free plastic containers and frozen in a freezer at -20°C during the time of data collection in the Gaza Strip, prior to their

importation as frozen samples into the UK once the relevant licences had been obtained. At the university laboratory the samples were stored in a -20°C freezer prior to F analysis.

Samples were analysed for F concentration using direct or indirect methods as appropriate and data on F were entered into the Fluoride Database to enable estimation of the contribution of foods, drinks and toothpastes to TDFI ¹³.

The F concentration in waters and non-milk based drinks was measured directly by F-Ion Selective Electrode after adding TISAB II (Total Ionic Strength Adjustment Buffer) ¹⁵.

Indirect silicon-facilitated diffusion methods were used to measure F concentration of milk-based drinks, and foods as well as toothpaste samples and expectorated saliva samples¹⁵⁻¹⁸. F intake from consumed drinking waters (from all different sources: filtered home tap water, purchased filtered water and water from private ground water wells) was calculated as follows: ((F concentration in water (mg/L) from Source 1 × volume of water (L) from Source 1 consumed over 3 days) + (F concentration in water (mg/L) from Source 2 × volume of water (L) from Source 2 consumed over 3 days))/3.

In order to determine the contribution of foods made with water (e.g. Okra cuisine) to TDFI it was necessary to incorporate 3 values for F concentration of each type of food into the database, based on if the food was prepared with tap water with a low (<0.7 mg/l) medium (0.7-1.2 mg/l) or high F <1.2 m/l) concentration.

A similar method was used to estimate F intake from custom-made drinks (eg. orange drink) prepared with <0.7 mg/l, 0.7-1.2 mg/l or >1.2 mg/l F tap waters. These values were also entered into the Fluoride Database. The F intake (mg) from each type of food or drink prepared with home water was calculated based on its median F concentration (for that area) multiplied by the amount of that food or drink consumed.

For each type of purchased food and drinks not prepared with, or affected by, local tap water F only one F concentration was required and this was used for all three areas. The median value for the F concentration for each type of fruit and vegetable bought from the main vendors and shops in all areas was used as the F concentration of each vegetable and fruit consumed by participants. For similar items of food or drink with different brand names, a derived median value was used to estimate F intake.

Data on fluoride intake from foods, water and toothbrushing and data on body weight, were used to derive the TDFI for each participant (in mg/day and mg/kg bw/day). After estimating the TDFI and determining the proportion of F intake from each source (drinking water, foods, other beverages and toothbrushing), One Way ANOVA and Tukey's test was applied to compare differences in TDFI among children who received low, moderate or high F concentration tap waters.

Results

Demographic and anthropometric data

This study aimed to recruit 3 groups of 72 children from areas of high (>1.2 ppm) moderate ($1.2-0.7$ ppm) and lower (<0.7 ppm) fluoride the in tap water supply with an overall study sample size of $n=216$. The study successfully recruited 72 children from each identified area (based on previous analysis of tap water F concentration) but when the children were grouped according to the *measured* F concentration in the home tap water, 81 children received tap water containing <0.7 mg/l F, 72 received tap water containing between 0.7 and 1.2 mg/l F, while 63 received tap water containing >1.2 mg/l F. All participants completed the study. Overall the study sample included 112 girls and 104 boys aged between 42 and 56 months. All data were collected during summer months.

Table 1 shows the mean (\pm SD) age, weight and height of children according to the F concentration of tap water received. There were no statistically significant differences between the children in the three groups for either weight or height. The average mean EI (\pm SD) was $5.17 (\pm 1.41)$ MJ/d. The mean (\pm SD) PAL of children ($1.47 (\pm 0.41)$) was above the cut-off point of 1.1^{10} .

The majority of children's mothers were not in employment (93.5%). Approximately one quarter of participants' fathers were unemployed (25.9%), while 28.2% were in services, including shop and market workers and 23.6% were employed in craft and related trades. Most of the families (86.6%) lived under the poverty line and had monthly incomes of ≤ 1800 Israel New Shekels²⁰.

Chemical analysis

The working range for the F-ion Selective Electrode is 0.1-100ppmF based on the F standards usually available, however, by using the gold standards methods described by Martinez-Meir et al¹⁵

and used in this study, the limit of detection is 0.02mg/L with no upper limit for F concentration measurement.

A high level of precision was found for measurement of F concentration in water samples (Coefficient of Variation (CV) $\leq 2.81\%$ [range: 0.64%-2.82%]). For non-milk-based drinks the average recovery was 99.8% (range: 92.3%-103%). The F concentration in 4 different food samples (cracker, frosted wheat cereal, cornflake cereal and Bread with butter) and 3 different milk based drinks (strawberry milkshake, banana milkshake and milk) was analysed in triplicate. A re-analysis of the same 7 samples on a different day was done in triplicate. The 7 different food/drink samples were spiked with a F standard (1.0 ml) and the recovery of 7 samples was measured in triplicate. The recovery was 100% in all samples measured.

Fluoride content of water samples

The average intake of water was 460g/day (which was from tap water (113g/d), filtered home tap water (109 g/d), purchased filtered water (116 g/d) and water from private ground water wells (122 g/d)). The mean (\pm SD) F concentrations of the waters used for drinking among children receiving <0.7 mg/l F, 0.7-1.2 mg/l F, and >1.2 mg/l F tap waters were 0.11 (± 0.17), 0.14 (± 0.28) and 0.38 (± 0.63) mg/l F respectively and lower than the mean F concentrations of cooking waters (0.21 (± 0.15), 0.83 (± 0.28) and 1.52 (± 0.52) mg/l F respectively). Home tap water was used for cooking by the majority (85.6%) of participants' households (87.7%, 84.7% and 84.1% in the <0.7 , 0.7-1.2 and >1.2 mg/l F tap water groups respectively).

Fluoride content of foods

The collected samples included 162 different beverages and foods from across the 216 households, including 33 different Palestinian dishes and 17 different types of drinks made with water. The daily intakes of F from foods and from different drinks for the children residing in the low, moderate and high F areas are presented in Table 3. The most commonly consumed homemade dishes by study

population were Okra cuisine and Molokheya cuisine, both of which were prepared with home tap water. The F concentration of the Okra cuisine ranged between 0.16 - 3.14 mg/L and that of the Melokheya cuisine ranged between 0.08-2.85 mg/L. In this study population, 52.3% consumed tea as a drink, the fluoride concentration of which ranged between 0.12 - 2.21mg/L.

Total fluoride intake

Mean TDFI from all sources (drinking water, foods, other beverages and tooth brushing) increased as the F concentration of home tap water increased. There were highly statistically significant differences in the mean TDFI (mg F/d and mg F/kg BW/d) between children exposed to low, moderate and high F waters: children using low F tap water had a mean (\pm SD) TDFI of 0.02 (\pm 0.01) mg/kg bw/d. This was significantly lower than TDFI of 0.04 (\pm 0.01) for children receiving moderate F tap water, which in turn was significantly lower than the mean TDFI of 0.05 (\pm 0.03) for the children exposed to >1.2 mg/l F tap water (Table 2).

Table 3 shows that foods made the largest contribution to TDFI (Mean \pm SD = 63.8% \pm 16.74), compared with the contributions from other beverages (21.98% \pm 12.97) and drinking water (13.46% \pm 17.11). Only foods showed a gradual increase in the contribution to TDFI with increasing home tap water F concentration. In addition, the mean contribution of inadvertent toothpaste ingestion during tooth brushing to TDFI for the 216 children was less than 1% because only 11 children routinely brushed their teeth.

Discussion

Over 86% of the families in the current study lived under the poverty line and the fathers of approximately a quarter of children were unemployed. Concurrent published data²¹ reported a similar poverty rate (87.7%) but a higher unemployment rate (34.1%) in the Gaza Strip.

In the present study a 3-day food diary was chosen as the method to assess diet, because it provides information on the source of dietary F intake as well as portion size, time of consumption and ingredients used for food or drink preparation. Although other researchers have recommended the duplicate plate method²² for determining F intake, this does not provide information on source of F unless a diary of food type, portion size and time of consumption is kept concurrently. The duplicate plate method is also expensive due to the need to provide an additional portion which may have been prohibitive with this current study population.

There are no available food tables for the Gaza Strip and therefore the UK food composition tables 'McCance and Widdowson's The Composition of Foods' (and supplements) were used to determine EI. These are the table which in general are used by nutritionists in the Gaza Strip. Some of the foods consumed were not present in the food tables and so the closest matches were used. In the case of homemade dishes where there was no similar food, codes were assigned to different components of the dish based on recipe inspection/dissection to determine proportions.

There are no specific dietary recommendations for the Gaza population. The EI of the study population (girls = 5.10 (\pm 1.47) MJ/day and boys = 5.25 (\pm 1.34) MJ/day) was lower than the UK Estimated Average Requirement for energy for 4-6 year olds (female = 6.46, and male = 7.16 MJ/day respectively) and WHO recommendations^{9, 10}. This may be attributed to the deterioration in the economic situation as a result of a continuous Gaza Strip boundary enclosure during the stage of data collection, although underreporting of dietary intake cannot be ruled out.

The mean TDFI of children (0.02, 0.04 and 0.05 mg/kg BW/d respectively for children living in the <0.7, 0.7-1.2, and >1.2 mg/l F areas) did not exceed the suggested optimal TDFI for children (0.05 – 0.07 mg/kg body weight/day)¹. The reported TDFI was low compared with TDFI of 4 year-old Iranian children²³ and 1.5-3.5 year-old children from the USA²⁴. The lower food intake overall, a trend towards the use of filtered water consumption for drinking, and a predominant absence of toothbrushing in the present study may explain the lower TDFIs in these children.

The mean TDFI of participants in the present study who received <0.7 mg/l F tap water mg/l (0.39 mg/d and 0.02 mg/kg BW/d) was lower than that of 3-4 year-old children living in New Zealand²², Colombian 2-3 year-olds²⁵ and German 3-6 year olds²⁶, but higher than that of Japanese 3-5 year-olds²⁷.

For participants from areas with 0.7-1.2 mg/l F tap water the TDFI (0.57 mg/d, 0.04mg/kg BW/d) was approximately half that of 1.5 - 3 year-olds children in Brazil²⁸ but was higher than that found in 3-4 year-old children from New Zealand²² and for 6 year old children receiving tap water with a similar F concentration in the UK⁵. This may be due to the greater use of home tap waters for food preparation in Gaza Strip compared with the UK and New Zealand.

For participants from areas with >1.2 mg/l F, the TDFI (0.79 mg/d, 0.05mg/kg BW/d) was one quarter of that found in the Iranian study²³.

In terms of dental fluorosis risk, it has been suggested that dental fluorosis in permanent teeth could result from F intakes ≥ 0.04 mg/kg bw/day at permanent teeth development age²⁹. On this basis only the children who received <0.7 mg/l F home tap water in the Gaza Strip were at lower risk of dental fluorosis. However, all children had intake below the optimum range of 0.05-0.07mg/kg/day¹.

In the present study, drinking water contributed 13.5 % of total F intake. This proportion is much lower than that reported for Iranian children²³, of a similar age, where drinking water contributed to over half (44-60%) of total F intake. However, the volume of drinking water intake (which was

mainly from tap water) - of the Iranian children (1139 g/d)³⁰, was approximately two times higher than the volume of drinking water (460 g/day) of the children from Gaza Strip. This may be due to a higher consumption of other types of drinks, however, the possibility of under reporting fluid intake cannot be ruled out, as urinary volumes were within the normal range (unpublished data). A lower consumption of water might explain why F intake from drinking water was less in the Gaza Strip children than in the Iranian children exposed to a similar tap water F concentration.

Despite F in drinking water being proposed as the primary source of F intake in different communities^{2,4}, this was not the case in the present study. Indeed, it can be postulated that recent changes in drinking water habits and use of drinking water from other sources (filtered home tap water, purchased filtered water and water from private ground water wells) in the Gaza Strip, as illustrated in the results, reduced the contribution of tap water F to total F intake.

The contribution of other drinks (beverages other than water) to TDFI among children in the Gaza Strip who received home tap water with a low or moderate F concentration, (~22%) was lower than the contribution of other beverages to TDFI of British 6 year old children⁵. This was probably because lower economic status for families in Gaza Strip and consequently less use of purchased drinks.

In the present study solid foods made a larger contribution to F intake compared with drinks across all three tap water groups, contrasting with the aforementioned study of Iranian children⁵ in which the F contribution from foods was estimated to be 12-22%, while from beverages other than tap water it was 28-35% of TDFI²³. In the present study, foods were the primary source of total F intake and this may be attributed to the widespread use of home tap water in their preparation.

F intake from toothbrushing contributed only 0.04% to TDFI for all children and 1.66% for the 11 children (5.1%) who brushed their teeth. The F concentrations of analysed toothpastes samples ranged between 270 and 1300 mg/l F. The extremely infrequent toothbrushing behaviour among

children in the Gaza Strip reduced the impact of F intake from toothpaste ingestion on TDFI. As a result, the average contributions of diet to TDFI were 99.7% and 98.8% among children who received <0.7 and 0.7-1.2 mg/l F tap water respectively. These values are much higher than those reported for children in the US aged 16-40 months (27.4%- 61.3% respectively) ²⁴. Data from Iran³⁰ have also show toothbrushing to make a larger contribution to TDFI, compared with the present study.

In summary, the current study found that the TDFI was less in children from Gaza Strip compared with children living in other societies. The lower TDFI may be attributed to the low level of exposure to toothpaste in this population group. Furthermore, as little tap water was consumed as a drink, foods prepared with tap water made the largest contribution to TDFI.

In conclusion, there was a statistically significant difference in mean TDFI between children exposed to <0.7, 0.7-1.2 and >1.2 mg/l F tap waters. Home tap water F concentration significantly impacted the TDFI of children in the Gaza Strip, but primarily through consumption of home-prepared and home-cooked foods, rather than through drinking the water. In order to determine if these differences in exposure to fluoride in childhood impact on the permanent dentition, a study to follow up the dental fluorosis occurrence and caries experience in permanent teeth of this cohort of children is warranted. If dental fluorosis in the Gaza Strip persists as a dental health problem, food preparation using filtered water should be encouraged, especially if dental caries prevention programmes are introduced to encourage toothbrushing with fluoridated toothpaste.

Bullet points

Why this paper is important to Paediatric Dentists

- Shows the relevant importance of difference sources of F to total intake in children with different levels of F in tap water.
- Highlights the differences in F intake between a Gaza Strip population and other populations.
- Provides reference data of fluoride intake and sources of F for children from the State of Palestine.

Conflict of interest

The authors declare no conflict of interest.

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Table 1. Mean (\pm SD) age, weight and height of 216 Gaza Strip children aged 3-4 years receiving tap water containing either <0.7, 0.7-1.2 or >1.2 mg/l F.

variables	F concentration in tap water (mg/l F)			
	<0.7 mg/l (n=81)	0.7-1.2 mg/l (n=72)	>1.2 mg/l (n=63)	Total
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Age (months)	48.2 \pm 3.9	49.1 \pm 3.7	49.3 \pm 3.9	48.8 \pm 3.9
Height (cm)	100.2 \pm 4.3	100.2 \pm 4.3	100.7 \pm 4.6	100.7 \pm 4.5
Weight (kg)	16.2 \pm 1.9	16.2 \pm 1.9	16.2 \pm 2.2	16.2 \pm 2.1

Table 2 Mean (\pm SD) total daily fluoride intake (TDFI) in mg/d and mg/kg bw/d of 216 children in the Gaza Strip according to F concentration in home tap water supply

F concentration in home tap water	No. of children	Energy intake (MJ/d)	Mean (\pm SD) F	TDFI (mg/d)*	TDFI (mg/ kg bw/d)	One Way ANOVA & Tukey's test
			concentration in home tap water (ppm F)			
		Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	
Low <0.7 ppm F	81	5.32 \pm 1.48	0.21 \pm 0.15	0.39 \pm 0.15	0.02 \pm 0.01	Low vs moderate (P< 0.0001)
Moderate 0.7-1.2 ppm F	72	5.08 \pm 1.20	0.91 \pm 0.13	0.57 \pm 0.21	0.04 \pm 0.01	Moderate vs high (P< 0.0001)
High >1.2 ppm F	63	5.07 \pm 1.53	1.71 \pm 0.35	0.79 \pm 0.45	0.05 \pm 0.03	High vs low (P< 0.0001)
All participants	216	5.17 \pm 1.41	0.88 \pm 0.65	0.57 \pm 0.33	0.04 \pm 0.02	

Table 3 Mean (\pm SD) TDFI (in mg/kg bw/d) and mean (\pm SD) relative contribution (%) by source of F in 216 children in the Gaza Strip

F concentration in home tap water (ppm F)	No. of children	Mean \pm SD F concentration in home tap water (ppm F)	Sources of total F intake				
			Mean \pm SD Total daily F intake(mg/kg bw/day)				
			[Mean \pm SD %]				
			Dietary F intake*				**F intake from tooth-brushing
			Foods	Other beverages	Drinking water (all sources)	Total dietary fluoride intake	
<0.7ppmF	81	0.21 \pm 0.15	0.01 \pm 0.01 [59.62 \pm 13.98]	0.01 \pm 0.00 [28.05 \pm 12.30]	0.003 \pm 0.005 [12.29 \pm 14.45]	0.02 \pm 0.01 [99.96 \pm 0.29]	0.00 \pm 0.00 [0.04 \pm 0.29]
0.7-1.2 ppmF	72	0.91 \pm 0.13	0.02 \pm 0.01 [65.71 \pm 17.64]	0.01 \pm 0.00 [21.32 \pm 13.48]	0.005 \pm 0.010 [11.74 \pm 16.80]	0.04 \pm 0.01 [98.78 \pm 6.22]	0.01 \pm 0.01 [1.22 \pm 6.22]
>1.2 ppmF	63	1.71 \pm 0.35	0.03 \pm 0.02 [67.16 \pm 18.02]	0.01 \pm 0.00 [14.93 \pm 8.99]	0.011 \pm 0.019 [16.93 \pm 20.13]	0.05 \pm 0.03 [99.02 \pm 5.29]	0.01 \pm 0.02 [0.98 \pm 5.29]
All Groups	216	0.88 \pm 0.65	0.02 \pm 0.01 [63.85 \pm 16.74]	0.01 \pm 0.00 [21.98 \pm 12.97]	0.006 \pm 0.012 [13.46 \pm 17.11]	0.04 \pm 0.02 [99.29 \pm 4.60]	0.01 \pm 0.01 [0.71 \pm 4.60]

* Sum of F intakes from foods, other beverages and drinking water.

** The contribution of toothbrushing to TDFI for the 216 children, the number of toothbrushing children exposed to <0.7, 0.7-1.2 and >1.2 mg/l F tap waters were 2, 5, 4 respectively